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RELATIONSHIP OF THE PARAMETERS OF ENDOGENOUS INTOXICATION WITH FATTY ACIDS IN PATIENTS WITH PHLEGMONS OF THE MAXILLOFACIAL REGION

Summary. In the period from 2008 to 2011 we observed 42 children with phlegmon of the maxillofacial region (MFR). In these patients a decrease of malondialdehyde (MDA) content to 87.4 % had been detected against decrease of catalase activity (CA) to 68.9 % ($P < 0.001$) with 6-fold increase of MDA/CA ratio. The content of MSM_{254} and MSM_{280} were 112.5 and 60.7 %, respectively, and stability factor of protein — 75.9 % of the parameters of control group. The correlation between the parameters of endogenous intoxication and content of fatty acids in the blood of sick children with phlegmons of MFR has been studied: a high correlation is observed between the content of MDA and fatty acids, and the average correlation — MDA and saturated fatty acids. Catalase activity is highly correlated with both saturated and unsaturated fatty acids.

Key words: phlegmon, endogenous intoxication, fatty acids, the correlation.

Actuality of the Problem

Despite advances in the prevention and treatment of phlegmon of the maxillofacial region in children, the number of diseases is increasing from year to year [1, 6, 9, 10].

In this connection, the study of the pathogenesis, improvement of diagnosis and treatment of phlegmon of maxillofacial region (MFR) is one of the most pressing issues in maxillofacial surgery [1, 5, 6, 9, 10, 12].

Mechanisms of the origin, development and course of inflammatory diseases, including phlegmon of MFR are inextricably connected with the reactivity of the organism [5, 6, 9, 12].

An integrated approach to the study of the pathogenesis, diagnosis and treatment, as well as forecasting the pathology at present stage requires a thorough study of fatty acids in the blood that are directly involved in the process of lipid peroxidation, resulting the endogenous intoxication. Studying the relationship of fatty acids content with endogenous intoxication indicators allows revealing the pathogenesis of inflammation and thus provides an opportunity to prove treatment strategy.

In this connection, the aim of this work is to study the relationship of indicators of endogenous intoxication containing fatty acids in sick children with phlegmon of maxillofacial region.

Materials and Methods

On the study involved 42 children aged 2–14 with phlegmon of MFR in were for the period from 2008 to 2011. They are hospital patients at the Department of maxillofacial surgery

in Regional multifield medical children centre Samarkand, and 15 healthy children of similar age.

Gas chromatographic analysis of fatty acids from serum was carried out according to method of N.K. Mukhammadiev and Sh.M. Ibadova [8]. In the plasma of venous blood markers of endogenous intoxication — MSM_{254} , MSM_{280} [2], malondialdehyde (MDA) [7], the activity of the antioxidant catalase enzyme (CA) [2] was determined. The coefficient MDA/CA and MSM_{280}/MSM_{254} — stability coefficient of protein (SCP) have been calculated.

Statistical analysis of obtained numerical data was performed using Student's test on Excel 2010, the correlation coefficient was calculated by the method of the least squares at $P = 0.95$.

Results and Discussion

Findings on determination of the parameters of endogenous intoxication and content of fatty acids are shown in Table 1.

The data of table shows that the content of the secondary products of lipid peroxidation — MDA increased by 87.4 % against decrease of catalase activity by 68.9 %, the ratio of MDA/CA increased 6 times, indicating a remarkable activation of free radical oxidation. MSM were accumulated in blood serum: content of MSM_{254} increased by 112.5 %, and the MSM_{280} — by 60.7 % relatively to the normal ($P < 0.001$).

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Table 1. Value of indicators of endogenous intoxication and fatty acids in children with phlegmon of MFR

Parameters	Unit of measure	Groups	
		Control	Study
Parameters of endogenous intoxication			
MDA	mkmol/l	3.50 ± 0.23	6.56 ± 0.28*
Catalase	mkkat/s·l	0.90 ± 0.06	0.28 ± 0.03*
MSM ₂₅₄	Conventional unit (c.u.)	0.24 ± 0.03	0.51 ± 0.04*
MSM ₂₈₀	c.u.	0.28 ± 0.03	0.451 ± 0.04*
SCP	c.u.	1.16 ± 0.07	0.88 ± 0.084*
MDA/Catalase	mkmol·s/mkkat	3.89 ± 0.16	23.43 ± 1.38*
Content of fatty acids			
C (16:0)	%	28.48 ± 2.02	31.46 ± 2.80
C (16:1)	%	6.74 ± 0.44	8.79 ± 0.72*
C (18:0)	%	2.32 ± 0.16	2.23 ± 0.14
C (18:1)	%	18.63 ± 1.32	16.68 ± 0.82*
C (18:2)	%	35.64 ± 2.46	34.04 ± 2.16
C (18:3)	%	0.62 ± 0.04	0.60 ± 0.02
C (20:4)	%	2.86 ± 0.16	2.23 ± 0.21
Other	%	2.98 ± 0.12	1.92 ± 0.14*
Σ unsaturated fatty acids		69.49 ± 0.54	63.60 ± 0.42*

Note: * — the stability coefficient of the protein was 75.9 % as compared to the control group ($P < 0.001$).

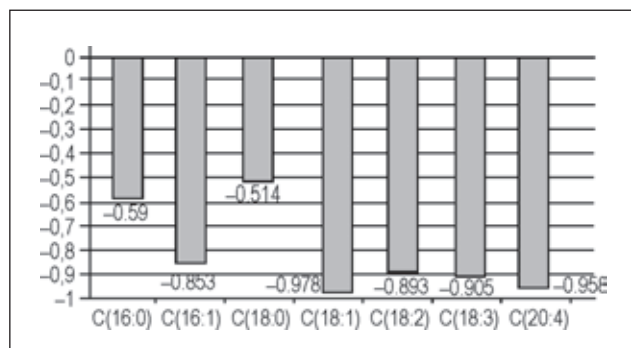


Figure 1. Correlation between the content of MDA and the fatty acids

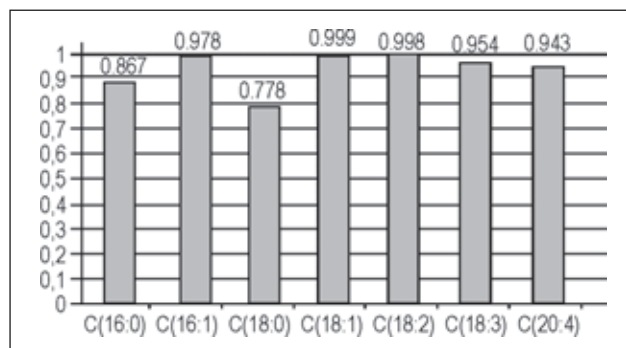


Figure 2. Correlation between the activity of catalase and the content of fatty acids

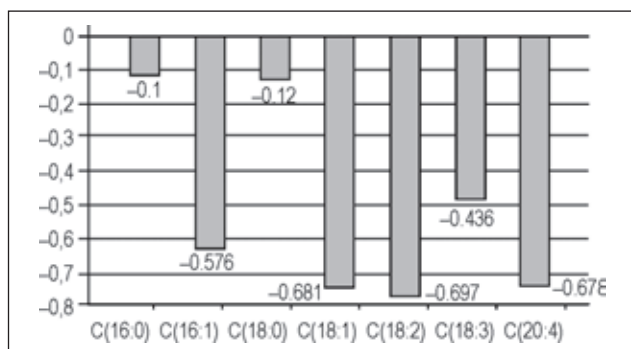


Figure 3. Correlation between the content of MSM₂₅₄ and fatty acids

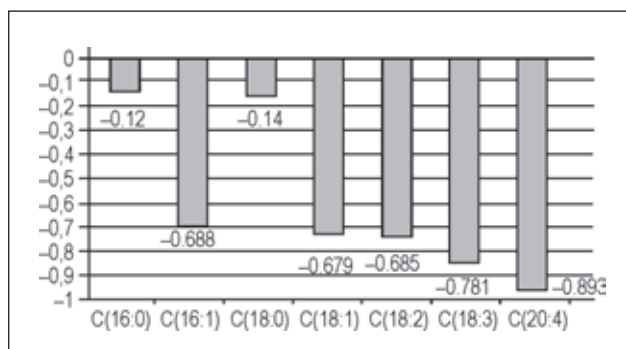


Figure 4. Correlation between the content of MSM₂₈₀ and fatty acids

Findings suggest that the expression of endogenous intoxication in children with phlegmon of MFR contribute to the development of endogenous intoxication, which is revealed in the fact that an accumulation of hydrophilic markers of endotoxemia — MSM occurs against the activation of free radical oxidation.

It is also shown from Table 1 that in the blood of sick children the content of palmitic (from 28.15 ± 1.52 to 32.88 ± 1.60) and stearic acid (from 2.36 ± 0.12 to 3.52 ± 0.12) was significantly increased, and the content of palmitoleic acid significantly reduced (from 8.29 ± 0.42 to 6.69 ± 0.40). It can be explained by the peroxide oxidation of double bonds contained in the molecules of fatty acids. Statement is confirmed by the significant decrease of the total content of unsaturated fatty acids relatively to the indicators of the control group because of the activation of lipid peroxidation process in patients with phlegmon of the maxillofacial region.

In order to identify the role of fatty acids, especially unsaturated ones in the formation of endotoxins we have studied correlation between the parameters of endogenous intoxication and content of fatty acids in the blood of sick children with phlegmons of MFR. The results obtained in the form of histograms are shown in Figures 1–4.

As can be seen from the data, that a high correlation between the content of MDA and fatty acids in the blood of children with phlegmon of MFR is observed, namely with C (16:1) – 0.853, C (18:1) – 0.978, C (18: 2) – 0.893, C (18:3) – 0.905 and C (20:4) – 0.958. And with saturated fatty acids the average correlation is C (16:0) – 0.59, C (18:0) – 0.514.

In contrast to MDA the catalase activity is highly correlated with both saturated and unsaturated fatty acids: C (16:0) – 0.867, C (16:1) – 0.978, C (18:0) – 0.778, C (18:1) – 0.999, C (18:2) – 0.988, C (18:3) – 0.954 and C (20:4) – 0.943.

It is known that low molecular weight peptides are accumulated as a result of free radicals, which are formed in the acceleration process of lipid peroxidation. Proof of that is the average correlation between the MSM_{254} , MSM_{280} and unsaturated fatty acids, which we have identified (Fig. 3, 4).

Findings confirm once more that in the suppurative inflammatory processes of MFR, particularly of phlegmons the beginning of the process is the activation of lipid peroxidation, which arise as a result of microbial contamination. In consequence of which the content of unsaturated fatty acids is reduced due to the break of the double bonds and accumulated under oxidized products of lipid peroxidation that causes toxemia in the body. Established facts dictate that while the development of therapeutic measures the main attention must be focused on the process of normalization of impaired lipid peroxidation, detoxification of the body.

It is known from the literature materials that ozone reacts with semi-unsaturated fatty acids of the membrane of red blood cells, peroxides and ozonides are formed. In this the cell membrane gets flexible, allowing the newly formed peroxides better get into the cell (ozone can not enter the cell by itself) the other way round, but on the other hand improves the deformability of erythrocytes. Improving the ability of red blood cells to change their shape allows them to penetrate into the most inaccessible parts of the vascular bed, which helps to improve microcirculation. Peroxides, which fall into the cell, affect its metabolism,

but they cannot be accumulated there because of the presence of intracellular antioxidant — reduced glutathione [13]. Based on this and on the basis of findings we consider the use of ozone therapy in the treatment of phlegmon of MFR justified.

Conclusions

1. It is found that in the patients with phlegmon of MFR a decrease of MDA content up to 87.4 % against decrease of CA up to 68.9 % with the increase of the ratio of MDA/CA by 6 times is observed. The content of MSM_{254} and MSM_{280} were 112.5 and 60.7 %, respectively, and stability factor of protein — 75.9 % of the parameters of control groups.

2. The relationship of indicators of endogenous intoxication containing fatty acids in children with phlegmon of maxillofacial region has been studied and high correlations between the parameters of endogenous intoxication and content of unsaturated fatty acids has been found.

3. Significant changes in the content of fatty acids and parameters of endogenous intoxication and high correlation between them are basis for using ozone therapy in the treatment of phlegmon of MFR in children.

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ВЗАИМОСВЯЗЬ ПОКАЗАТЕЛЕЙ ЭНДОГЕННОЙ ИНТОКСИКАЦИИ С СОДЕРЖАНИЕМ ЖИРНЫХ КИСЛОТ У ДЕТЕЙ С ФЛЕГМОНАМИ ЧЕЛЮСТНО-ЛИЦЕВОЙ ОБЛАСТИ

Резюме. В период от 2008 до 2011 года под наблюдением находились 42 ребенка с флегмонами челюстно-лицевой области (ЧЛО). У этих больных выявлено уменьшение содержания малонового диальдегида (МДА) до 87,4 % на фоне снижения каталазной активности (КА) до 68,9 % ($P < 0,001$) и возрастание соотношения МДА/КА в 6 раз. При этом содержание МСМ₂₅₄ и МСМ₂₈₀ составило соответственно 112,5 и 60,7 %, а коэффициент устойчивости белка — 75,9 % ($P < 0,001$) от показателя контрольной группы. Изучена корреляционная связь

между параметрами эндогенной интоксикации и содержанием жирных кислот в крови больных детей с флегмонами ЧЛО: высокая корреляция наблюдается между содержанием МДА и жирных кислот и средняя корреляция — МДА и насыщенных жирных кислот. Активность каталазы высоко коррелирует с уровнем как насыщенных, так и ненасыщенных жирных кислот.

Ключевые слова: флегмона, эндогенная интоксикация, жирные кислоты, корреляция.

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ВЗАЄМОЗВ'ЯЗОК ПОКАЗНИКІВ ЕНДОГЕННІ ІНТОКСИКАЦІЇ З УМІСТОМ ЖИРНИХ КИСЛОТ У ДІТЕЙ ІЗ ФЛЕГМОНАМИ ЩЕЛЕПНО-ЛИЦЬОВОЇ ДІЛЯНКИ

Резюме. У період з 2008 до 2011 року під спостереженням були 42 дитини з флегмонами щелепно-лицьової ділянки (ЩЛД). У цих хворих виявлене зменшення вмісту малонового діальдегіду (МДА) до 87,4 % на фоні зниження каталазної активності (КА) до 68,9 % ($P < 0,001$) і вікові співвідношення МДА/КА в 6 разів. При цьому вміст МСМ₂₅₄ і МСМ₂₈₀ становив відповідно 112,5 і 60,7 %, а коефіцієнт стійкості білка — 75,9 % ($P < 0,001$) від показника контрольної групи. Вивчений кореляційний зв'язок

між параметрами ендогенної інтоксикації й умістом жирних кислот у крові хворих дітей із флегмонами ЩЛД: висока кореляція спостерігається між умістом МДА і жирних кислот і середня кореляція — МДА й насичених жирних кислот. Активність каталази високо корелює з рівнем як насичених, так і ненасичених жирних кислот.

Ключові слова: флегмона, ендогенна інтоксикація, жирні кислоти, кореляція.